WHAT IS CLAIMED IS:

1. A packing ring segment for use in forming a labyrinth seal with a turbine shaft rotatably mounted within the casing of an axial flow elastic fluid turbine, wherein said axial flow elastic fluid turbine includes at least one stage having (i) at least one diaphragm stationarily mounted in said casting and having a plurality of steam directing nozzles, and (ii) a rotor fixedly attached to said turbine shaft and having a plurality of blades bounded by a shroud and disposed adjacent to said plurality of steam directing nozzles, said packing ring segment comprising:

a body portion for mounting within a portion of said diaphragm and having a longitudinal extent, a vertical extent, and a horizontal extent, and being particularly adapted for mounting in a portion of said diaphragm, said body portion having a groove formed along said vertical extent and extending along said longitudinal extent; and

a plurality of brush segments mounted within said groove of said packing ring segment, each said brush segment having a packet of bristles with said bristles having tip portions trimmed to terminate along a radius of curvature continuously extending along the longitudinal extent of said body portion so as to form a labyrinth seal with said turbine shaft, and

each said bristle being disposed in a plane substantially parallel to the principal plane of said rotor and extending in the direction of rotation of said turbine shaft.

2. The packing ring segment of claim 1, wherein the bristles within each said bristle ~~segment~~ packet are bound between a pair of plates having an incised channel to receive the base end portion of said bristles.

3. The packing ring segment of claim 2, wherein said plates of each said brush segment have a bottom edge surface with a radius of curvature adapted to conform to the radius of curvature of said groove formed in said vertical portion.

4. The packing ring segment of claim 1, wherein the bristles within each said brush segment are bound within a channel by a core strip securing said bristles within said channel.

15. An elastic fluid turbine employing seals to minimize leakage between rotating and stationary components and utilizing the combination of a segmented seal ring supported by and at least partially contained in an annular groove formed in a stationary casing to permit motion of said seal ring between a large diameter position and a small diameter position corresponding respectively to large and small clearance of said seal ring with regard to the rotating shaft said seal ring groove being partially defined by a pair of opposing, spaced apart shoulders on said casing which form an opening of said groove extending radially into the clearance area between said casing and said rotating shaft, said turbine including at least one stage having (i) at least one diaphragm stationarily mounted in said casing and having a plurality of steam directing nozzles, and (ii) a rotor fixedly attached to said turbine shaft and having a plurality of blades bounded by a shroud and disposed adjacent to said plurality of steam directing nozzles,

each segment of said seal ring including an inner arcuate portion having seal teeth extending therefrom in the direction of and adjacent to said rotating shaft a radially outwardly facing arcuate surface on said seal ring segment which is located opposite to a radially inward facing arcuate surface on said casing for limiting said large clearance position by contact between said opposing surfaces, an outer ring portion disposed within said seal ring groove for both axial and radial movement therein and having a pair of shoulders extending axially in opposite directions for making radial contact respectively with said pair of spaced apart shoulders on said casing and thereby limiting said small clearance position;

a neck portion connected between said inner arcuate portion and said outer ring portion and extending between said casing shoulders, said neck portion having an axial thickness which is less than the distance between said opposing casing shoulders to thereby axially locate said seal ring segment against one of said casing shoulders and provide a contact pressure seal at the said side of said neck portion which is subject to lower turbine fluid pressure;

a radial positioning means comprising a spring against said ring segments to forcibly cause said segments to move to said large clearance position contacts, while working fluid which flows into the annular space between said casing and said ring segments urges said segments toward said small clearance position, whereby at low speed and small turbine loads the spring forces will predominate, while at high flows and high working fluid pressure the pressure forces will predominate;

each of said ring segments comprising:

a body portion for mounting within a portion of said diaphragm and having a longitudinal extent, a vertical extent, and a horizontal extent, and being particularly adapted for mounting in a portion of said diaphragm, said body portion having a groove formed along said vertical extent and extending along said longitudinal extent; and

a plurality of brush segments mounted within said groove of said packing ring segment, each said brush segment having a packet of bristles with said bristles having tip portions trimmed to terminate along a radius of curvature continuously extending along the longitudinal extent of said body portion so as to form a labyrinth seal with said turbine shaft, and

each said bristle being disposed in a plane substantially parallel to the principal plane of said rotor and extending in the direction of rotation of said turbine shaft.

6. The fluid turbine seal arrangement as recited in claim 5, wherein said radial positioning means includes a flat spring interposed between said casing shoulders and an inner surface of said outer ring portion of said ring segment.

7. The fluid turbine seal arrangement as recited in claim 6, wherein said inner arcuate portion of said seal ring segment comprises an inner ring portion connected at one side to said neck portion and includes said radially outward facing arcuate surface for limiting said large clearance position by said contact with said casing surface said inner ring portion having said seal teeth extending therefrom.

8. The fluid turbine seal arrangement as recited in claim 7, where in said inner ring portion extends substantially ~~form~~ from said neck portion axially in both directions such that said inner ring portion is substantially wider than said neck portion and has said seal teeth extending therefrom radially into said clearance area.

9. The fluid turbine seal arrangement as recited in claim 8, wherein said radially outwardly facing arcuate surface in said seal ring segment which is located opposite to a radially inward facing arcuate surface of said casing comprises the radially outward facing surfaces of said inner ring portion.

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10. A packing ring for use in forming a seal with a turbine shaft rotatably mounted within the casing of an axial flow elastic fluid turbine, wherein said axial flow elastic fluid turbine includes at least one stage having (i) at least one diaphragm stationarily mounted in said ~~casing~~ Casing and having a plurality of steam directing nozzles, and (ii) a rotor fixedly attached to said turbine shaft and having a plurality of blades bounded by a shroud and disposed adjacent said plurality of steam directing nozzles, said packing ring comprising a plurality of packing ring segments, each said packing ring segment being mounted in a groove circumferentially in said diaphragm for forming a seal with said turbine shaft;

each said packing ring segment including

a body portion for mounting within said circumferentially formed groove and having a longitudinal extent, a vertical extent, and a horizontal extent, and being particularly adapted for mounting in a portion of said diaphragm, said body portion having a brush mounting groove formed along said vertical extent and extending along said longitudinal extent; and

a plurality of brush segments mounted within said brush mounting groove of said packing ring segment, each said brush segment having a packet of bristles with said bristles having tip portions trimmed to terminate along a radius of curvature adapted to form a steam seal with said turbine shaft, and

each said bristle being disposed in a plane substantially parallel to the principal plane of said rotor and extending in the direction of rotation of said turbine shaft; and

each segment of said seal ring comprising:

an inner arcuate portion having seal teeth extending therefrom in the direction of and adjacent to said rotating shaft a radially outwardly facing arcuate surface on said seal ring segment which is located opposite to a radially inward facing arcuate surface on said casing for limiting said large clearance position by contact between said opposing surfaces, an outer ring portion disposed within said seal ring groove for both axial and radial movement therein and having a pair of shoulders extending axially in

opposite directions for making radial contact respectively with said pair of spaced apart shoulders on said casing and thereby limiting said small clearance position;

a neck portion connected between said inner arcuate portion and said outer ring portion and extending between said casing shoulders, said neck portion having an axial thickness which is less than the distance between said opposing casing shoulders to thereby axially locate said seal ring segment against one of said casing shoulders and provide a contact pressure seal at the said side of said neck portion which is subject to lower turbine fluid pressure; and

a radial positioning means comprising a spring against said ring segments to forcibly cause said to move to said large clearance position contacts, while working fluid which is flows into to the annular space between said casing and said ring segments will urge said segments toward said small clearance position, whereby at low speed and small turbine loads the spring forces wilt predominate, while at high flows and high working fluid pressure the pressure forces will predominate;

11. The packing ring of claim 10, wherein the bristles within each said bristle ~~segment~~ packet are bound between a pair of plates having an incised channel to receive the base end portion of said bristles.

12. The packing ring of claim 11, wherein said plates of each said brush segment have a bottom edge surface with a radius of curvature adapted to conform to the radius of curvature of said groove formed in said vertical portion.

13. The packing ring of claim 10, wherein the bristles within each said brush segment are bound within a channel by a core strip securing said bristles within said channel.

14. The packing ring of claim 10, wherein said channel has a bottom edge surface with a radius of curvature adapted to conform to the radius of curvature of said groove formed in said vertical portion.

15. An axial flow elastic fluid turbine comprising:

an outer casting;

a turbine shaft rotatably supported in said outer casting; and

a plurality of turbine stages installed along said turbine shaft and contained within said outer casting, each said turbine stage including

a diaphragm stationarily mounted in a recess formed in said turbine casting and having a plurality of steam directing nozzles,

a rotor fixedly attached to said turbine shaft and having a plurality of blades bounded by a shroud band and being disposed adjacent said plurality of steam directing nozzles, and

a packing ring consisting of an arrangement of packing ring segments mounted in a circumferentially extending groove formed in said diaphragm and providing a continuously extending seal with said turbine,

each said packing ring segment including

a body portion for mounting within said circumferentially formed groove and having a longitudinal extent, a vertical extent, and a horizontal extent, and being particularly adapted for mounting in a portion of said diaphragm, said body portion having a brush mounting groove formed along said vertical extent and extending along said longitudinal extent; and

a plurality of brush segments mounted within said brush mounting groove of said packing ring segment, each said brush segment having a packet of bristles with said bristles having tip portions trimmed to terminate along a radius of curvature adapted to form a steam seal with said turbine shaft, and

each said bristle being disposed in a plane substantially parallel to the principal plane of said rotor and extending in the direction of rotation of said turbine shaft.

16. The axial flow elastic fluid turbine of claim 10, wherein the bristles within each said bristle packet are bound between a pair of plates having an incised channel to receive the base end portion of said bristles.

17. The axial flow elastic fluid turbine of claim 11, wherein said plates of each said brush segment have a bottom edge surface with a radius of curvature adapted to conform to the radius of curvature of said groove formed in said vertical portion.

18. The axial flow elastic fluid turbine of claim 10, wherein the bristles within each said brush segment are bound within a channel by a core strip securing said bristles within said channel.

19. The axial flow elastic fluid turbine of claim 13, wherein said channel has a bottom edge surface with a radius of curvature adapted to conform to the radius of curvature of said groove formed in said vertical portion.

20. The axial flow elastic fluid turbine as recited in claim 15, wherein said radial positioning means includes a flat spring interposed between said casing shoulders and an inner surface of said outer ring portion of said ring segment.

21. The axial flow elastic fluid turbine as recited in claim 15, wherein said inner arcuate portion of said seal ring segment comprises an inner ring portion connected at one side to said neck portion and includes said radially outward facing arcuate surface for limiting said large clearance position by said contact with said casing surface said inner ring portion having said seal teeth extending therefrom.

22. The axial flow elastic fluid turbine as recited in claim 21, where in said inner ring portion extends substantially from said neck portion axially in both directions such that said inner ring portion is substantially wider than said neck portion and has said seal teeth extending therefrom radially into said clearance area.

23. The axial flow elastic fluid turbine as recited in claim 22, wherein said radially outwardly facing arcuate surface in said seal ring segment which is located opposite to a radially inward facing arcuate surface of said casing comprises the radially outward facing surfaces of said inner ring portion.

24. A packing ring segment for use in forming a labyrinth seal with a turbine shaft rotatably mounted within the casing of an axial flow elastic fluid turbine, wherein said axial flow elastic fluid turbine includes at least one stage having (i) at least one diaphragm stationarily mounted in said casting and having a plurality of steam directing nozzles, and (ii) a rotor fixedly attached to said turbine shaft for rotation about an axis of rotation and having a plurality of blades bounded by a shroud band disposed within a principal plane of said rotor and adjacent said plurality of steam directing nozzles, said packing ring segment comprising:

a body portion for mounting within a portion of said diaphragm and having a longitudinal extent, a vertical extent, and a horizontal extent, and being particularly adapted for mounting in a portion of said diaphragm, said body portion having a groove formed along said vertical extent and extending along said longitudinal extent; and

a plurality of brush segments mounted within said groove of said packing ring segment, each said brush segment having a packet of bristles with said bristles having tip portions trimmed to terminate along a radius of curvature continuously extending along the longitudinal extent of said body portion so as to form a labyrinth seal with said turbine shaft, and

each said bristle being disposed at an acute angle with respect to the principal plane of said rotor.

25. The packing ring segment of claim 20, wherein the bristles within each said bristle segment are bound between a pair of plates having an incised channel to receive the base end portion of said bristles.

26. The packing ring segment of claim 21, wherein said plates of each said brush segment have a bottom edge surface with a radius of curvature adapted to conform to the radius of curvature of said groove formed in said vertical portion.

27. The packing ring segment of claim 20, wherein the bristles within each said brush segment are bound within a channel by a core strip securing said bristles within said channel.

28. A turbine or compressor comprising at least one packing ring segment as defined by claim 20.